

The Influences of Age, Sex and Mode  
~~Mode~~ of Transportation on Student Cognitive Maps

An Honors Thesis (ID 499)

by

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### Abstract

This research project studies the relationships between age, sex and driving status of subjects and characteristics of their cognitive maps, as drawn on a blank sheet of paper. Eight groups of subjects were formed using non-residents of the city specified in the study, Muncie, Indiana. The participant groups were categorized for the mapping task using a 2x2x2 matrix of independent variables: college freshman/sophomore, male/female, with car/without car.

Following verbal instructions, each subject gave informed consent. All subjects were then given paper and asked to draw a map of the Muncie/Ball State University area. A 10 minute time limit was imposed. The participants filled out an identification questionnaire specifying category variables before turning in their finished maps.

The drawings were analyzed using descriptive correlation methods, analysis of variance and chi-square analysis in a between groups design. The results supported the expectation that map characteristics would vary significantly relative to the independent variables. The ANOVAs showed significant effects on the number of major and minor streets; the number of university buildings, residences, natural and man-made landmarks, and scramble lights labelled. The chi-square results showed significant effects on the use of direction labels, the inclusion of the north and central parts of campus, the omission of east off-campus areas, and the center location.

## The Influences of Age, Sex and Mode of Transportation on Student Cognitive Maps

### Introduction

Cognitive mapping is the ability to form mental representations of the physical environment. These representations may not be photographically accurate, but they convey an individual's understanding of a place (Downs, 1977). Memories of past experiences form a mental frame of reference which is used when an individual actively perceives a place. This processing of new experiences in conjunction with old experiences has a major influence on an individual's ability to picture the layout of a place in one's mind, knowing how to get from place to place and recall the relationships between these places (Whyte, 1977).

There are many factors involved in the formation of mental maps. It has been said that the cognitive mapping ability is learned, yet mainly untaught; this allows for very individualized methods, skills, and techniques in the developing of mental maps (Downs, 1977). Individuals may observe how others try to remember places, as well as simply learn by trial-and-error. It is possible that the mental maps of each person are quite unique- yet similar in the basic ideas represented. Because people can remember similar things about places, it is sometimes assumed that everything and everyone views the world

in similar ways, but people can combine the various types of information (i.e. visual, auditory, taste, etc.) in different ways. The result is probably a very large variety of mental maps. For instance, one person may remember that the barn was red and beside a sweet smelling flower garden, while another person may remember that yellow flowers were at the far end of the yard which lies between the house and the noisy road. Such maps reflect the personal experiences that various individuals can have of the same place. Their maps may possess similar elements and basic relationships, yet organized and viewed uniquely (Downs, 1977).

The factors that may influence an individual's learning and/or perception of a place are numerous. The manual skills of an individual are likely to influence how that person transforms the perceived environment into an internal memory. As an example, a person who can draw well may draw a mental picture of a place using shapes, lines, etc., while a more verbal person may describe characteristics of a place with semantic memories. Familiarity with a type of place or possessing past experiences in places similar to the one being presently perceived might allow an individual to notice different things, more things, or fewer things relative to someone who has never experienced a place like the one being perceived. The latter person may notice only those outstanding characteristics of the place, or he/she may notice every little detail that others take for granted. An individual's academic background and resulting style of thinking can also be

a factor (Gould, 1974). Imagine the thought processes possessed by a computer programmer versus a nurse. The programmer might remember places as if it were a computer storage cell, with bits and bytes, pieces that have paths to other places in an abstract scheme; while a nurse might notice the characteristics of a place as if assessing a patient's symptoms, making a list of every detail. Furthermore, the amount and type of information that individuals have to process may also affect the mental map of a place. It has been suggested that a high quantity of information presented to individuals about a place results in more accurate and similar maps formed among those individuals, while low levels of map accuracy and similarity result when small amounts of information are made available to individuals about a place. For example, travelers have arguments among themselves when no one in the group is familiar with the route. It is as if everyone knows different facts (Gould, 1974).

Individuals can personalize their maps in other ways. Informal maps tend to be centered around a person's home. Egocentric maps are usually organized around the immediate location of that individual (Gould, 1974). The types of movement that an individual makes through a place cause different impressions on mental maps, for movement can be habitual movement, like the trips that college students make daily to their classes, which tend to lack environmental responsiveness. In such a case, things are simply ignored and taken for granted. Contrastingly, exploratory movement is

more responsive to immediate stimuli, the details of a place are recognized and remembered (Bechtel, 1970). Movement can also be active or passive; for instance, an individual perceives the environment differently when driving a car, or bicycling, relative to riding as a passenger in the car's back seat (Downs, 1977). These are just a few of the possible variables affecting how people can map out places in their minds.

Peter Gould (1977, p. 48) summarized all of this; "Our views of the world, and about people and places in it, are formed from a highly filtered set of impressions, and our images are strongly affected by the information we receive through this filter." By identifying the numerous, but relevant variables forming the filters influencing individuals' environmental perceptions, we recognize that people experience the world uniquely.

What is the relevance of this? By recognizing the role played by cognition (mental processing), we can learn to use its functions to our advantage. A main function of cognitive mapping is that it allows the individual to store experiences of a place into memory. An increased awareness of what that individual holds in memory and how this forms cognitive maps of places can increase our ability to share, both memories of mutual experiences as well as new information with those who did not or could not directly experience places with us.

By better understanding the various things that individuals notice and remember about the physical environment, we may

better understand man's decisions and actions concerning the environment; why people build how and where they do; why people travel to the places they do, or the like. This is an underlying principle of environmental perception research (Whyte, 1977). By knowing more about the subjective experiences of an environment had by individuals, management and policy strategies dealing with environmental problems may be improved as well (Downs, 1977). The application of such an increased understanding of environmental perception processes may result in great benefits for environmental interest areas. Peter Gould (1974, p. 178) emphasized the importance of this when he stated, "Planning in a humane economy, that places people first, must surely consider the mental images of places as a crucial input to policy decisions which affect, in such deep ways, the pattern and satisfaction of individual lives."

The study presented here is related to Roger Downs' approach to the study of cognitive mapping. Downs (1977) suggests an organizational approach to use. He posits that this process involves three types of information: whatness, whereness, and whenness. Theoretically, whatness might include such things as symbolic representations, identification methods, or labels. Whatness knowledge serves as a basis for the interpretation of cognitive information, for it represents the idea held in the mind of the individual. Like a stop sign, the word "stop" allows for quick recognition of specific characteristics of a place: cars, road, intersection, etc.

Whereness knowledge involves problem-solving, the



learning of placement and distance, the relationships of objects in space, and general orientation. Downs (1977) identified four steps included in the learning of whereness: orientation of position, choice of route which connects present location with the goal place, keeping track of one's movement and position as the route is used, and final recognition of the goal place. The last two steps depend strongly on comparing one's present perceptions of a place with those past perceptions of that place which are in memory.

Whenness deals with time-place relationships. Movement through space, and the mode of transportation used which influences the speed of movement, play roles in the perception of details as well as the judgment of distance between places (Downs, 1977). A store may seem to be five miles away when one is on foot, yet seem only one mile away by car. These concepts (whatness, whereness, and whenness) are relevant to the interpretation of the data obtained in the current study.

This study uses a method based on the work by Lynch (1977) in several of his projects. Lynch asked each subject to draw a map of a specified place. These maps were then analyzed using a set of questions to answer about each subject's map. The questions used in the current study related to Downs' (1977) concepts, some of them referring to how the individuals labelled their drawing, how the maps were oriented, or what types of movement they make within the specified area.

It is hypothesized that significant differences will be observed in the characteristics of maps for those subjects who

drive regularly in the specified area of Ball State University/Muncie, Indiana versus those who do not drive in this city regularly, for males versus females, and for college freshman versus college sophomores.

The purpose of this study is to better understand the unique experiences of the city had by Ball State University students. By identifying the different environmental characteristics recorded in their map drawings of the area, an increased understanding may be obtained.

### Method

This study investigated the influences of age, sex, and whether or not a participant drives regularly in the Muncie, Indiana area on how the individual draws a map of the city of Muncie.

Subjects. The subjects signed up for the study on sheets of paper that specified requirements for participation. Each sheet's requirements described a different experimental subject category as developed from the 2x2x2 matrix of variables, including: freshman/sophomore, male/female, with/with out car. These were the independent variables to be manipulated. This procedure was also intended to control the number of participants for each group of variables ( a minimum of 10 per group was the goal). Unfortunately, the resulting subject pool comprised varying numbers of subjects in each group. The total was 121. Various experiment times were arranged in order to

attract as many subjects as possible.

Procedure. During each session, subjects were allowed time to read and sign a consent form (see Appendix A). They then received verbal instructions and a piece of paper (see Appendix B), and were given 10 minutes in which to draw the map specified. Finally, subjects were asked to fill out a questionnaire identifying various independent variables (see Appendix C). No names were recorded, only codes were used to match maps with the correct questionnaires. Each map was later analyzed using a list of dependent variables to count or be identified and recorded for each map (see Appendix D for the dependent variable list and Table 1 for variable definitions).

### Results

The analysis of variance performed on the group means for the various dependent variables showed significant results ( $p < .05$ ) for the following: the number of major streets labelled, the number of minor streets labelled, the number of university buildings labelled, the number of residences labelled, the number of natural landmarks labelled, the number of man-made landmarks labelled, and the number of scramble lights labelled. The chi-square analysis performed on group percentages for specific dependent variables indicated significant effects for the following: the number of subjects using the label "north" and not using the labels "east," "south," and "west;" the number of subjects who included the north and central parts of campus, and

and who did not include the east area off-campus; and the location of participants' map centers was also significant. (See Tables 2 and 3.)

Those participants who were freshman at Ball State had the largest mean number of scramble lights labelled (Mean = .33,  $p=.042$ ). Sophomores labelled more minor streets (Mean = 2.61,  $p=.001$ ) and more man-made landmarks (Mean = .79,  $p=.034$ ). Male participants labelled more minor streets (Mean = 1.86,  $p=.047$ ) than females, while females labelled the most university buildings (Mean = 12.32,  $p=.000$ ) and residences (Mean = 3.86,  $p=.013$ ). Participants who drive in Muncie regularly labelled more university buildings (Mean = 12.32,  $p=.032$ ) than non-drivers as well.

Two-way interactions were only indicated in the sex/drive grouping. Males who drive in Muncie regularly labelled the largest mean number of major streets (Mean = 2.76,  $p=.046$ ). Females who drive in Muncie regularly labelled the second largest mean number of major streets (Mean = 1.26,  $p=.046$ ). Males who do not drive regularly in Muncie labelled the most natural landmarks (Mean = .64,  $p=.037$ ), while females who drive regularly in Muncie labelled the second largest mean number of natural landmarks (Mean = .35,  $p=.037$ ).

The chi-square analysis showed that over 80 percent of the participants did not include "north," "south," "east" or "west" direction labels, though if a label were to be used, it would be "north" for 17.4 percent did use it; only 14 percent used the other direction labels. The north part of campus was

one area of significance to be included in the subjects' maps, for 93 percent of the students included it ( $p=.003$ ). The central area of campus along McKinley Avenue was also significant with 77 percent of the participants including it on their maps ( $p=.000$ ). The east area off-campus was a significant area not to be included on subjects' maps, 86 percent did not draw it ( $p=.000$ ). The center location of the map indicated significance as well, with the library-TC (Teacher's College) area being of highest preference at 20.7 percent ( $p=.011$ ). (See Tables 4 and 5.)

The non-significant data are interesting as well. The number of parking places labelled was not significantly different between the driving and non-driving participants. Furthermore, many participants oriented their maps with north as "up" with south as a close second, but no significance was found. More participants included the east campus area than the south campus, and the south campus more than the west. Off-campus areas were all equally omitted. Of the areas of Muncie, north was the most included area, downtown was the second most, then east Muncie, then south Muncie, while none of the participants included the west area of Muncie.

Evaluation of the scale of participant drawings and distortions showed the area of the maps most often scaled largest was the north with 25.6 percent of the participants expanding this area relative to the rest of their maps. (See Table 6.) A large group of participants did not have significantly noticeable smallest scaled areas of their maps. The use of lines

to represent roads indicated that 52.9 percent of the participants used two parallel lines to represent roads, while 40.5 percent used only one line. Females tended to use two lines, and males tended to use only one. (See Table 7)

### Discussion

The data show significant influences of all three independent variables: age, sex, and driving status. ANOVA results suggest that freshman think of the scramble lights more than sophomores in creating their mental campus maps. A possible reason for this is that freshman are less familiar with the campus and must rely more on those things frequently experienced, and the scramble light is likely to be used by participants several times daily. The scramble light may be considered new and unusual to freshman, making it an outstanding characteristic of campus relative to sophomores, who may be more accustomed to it.

Sophomores labelled more minor streets and man-made landmarks relative to the freshman as well. Sophomores are more likely to have had multiple experiences with these places and things than freshman. This may result in better developed mental maps for sophomores which include details and more solid ideas of "whereness" and "whatness" in using Downs(1977) terms. It is possible that the more times that you experience a place, the more likely that you will recall its characteristics. Males

labelled more of the minor streets than females, which suggests that either a difference in which places are experienced by each sex exists, or a difference in what each sex remembers about a place. The second idea is also suggested in the labelling of university buildings, for females labelled significantly more buildings than males. Maybe the sexes do simply remember different things about the campus. Yet, the 2-way interactions for sex/driving status on the number of minor streets labelled also suggests that the sexes experience different places, or experience the same places in different ways. Males who drive in Muncie regularly labelled the most minor streets, while females who drive cars in Muncie regularly labelled the second most minor streets. Females who do not drive regularly in Muncie then labelled more minor streets than males who do not drive regularly in this city. Maybe males refer more to the names of streets when they drive but do not when they are walking, while females do not rely quite so much on street names while driving as males do, but rely more on street names as pedestrians than males. Evidently, males notice very different details about a place while driving compared to not driving, while females do not change the things that they notice quite so much. This may be related to spatial versus verbal training as well, something which is thought to be related to sex differences in socialization processes.

Females labelled more residences which include apartments, dorms, fraternity houses and private homes, therefore females may remember where people live and use such information more

often than males do. Non-drivers labelled more university buildings as reported before, but evidently the effect was not significant for no such 2-way interaction was found significant. Those who drive a car regularly in Muncie labelled the most major streets, and this seems logical. Most of the major streets are far beyond walking distance from the campus, and drivers need to know the names of such streets in order to find their routes and destinations, more so than might a passenger in the car. Another 2-way interaction was found for sex/driving status on the number of natural landmarks labelled. Males without cars labelled the most natural landmarks, while females who drive regularly in Muncie labelled the second most. Again, it is possible that males notice different things than females as pedestrians or as drivers.

The chi-square analysis showed that the north part of subjects' maps was most likely to be the largest, and it was also used as the orientation for "up". The north and central parts of campus were also the only ones to be significantly included in participants' maps. It seems as if these areas were most familiar and most important to students in remembering the campus. The central part of campus along McKinley is where most students travel in order to get to classes. The north campus may be familiar and important because one must travel through it in order to reach the large freshman parking lot, many restaurants and shops are that way, and so too is McGalliard Avenue which leads to I-69. These areas are high traffic areas,



one for daily classes and the other for less frequent trips. Sophomore males who do not drive regularly in Muncie were the group with the largest percentage not to include the north part of campus, 69 percent did not, while 53 percent did not include the central part of campus either. For this group, the campus is viewed differently relative to the rest of the student population studied. (See Appendix E for Map.)

The location for participants' map centers were also significantly different. It appears that most participants orient their maps realistically around the central parts of campus: 20.7 percent had the library-TC(Teacher's College) as center, 19.8 percent used the Architecture-RB(Robert Bell) Building as a map center, and 19.0 percent located the scramble light on Riverside Avenue as their center. The Quad is not a popular center for student maps, for only 5.0 percent used it, and only 1.7 percent oriented their maps around the shop area called the "Village." A more accurate idea of the reasons for such centering may be related to where each participant resides, for those living off-campus may have different centers than those living in the dorms, but no such statistics were compiled. From the Duck Pond to Riverside Avenue, McKinley Avenue appears to be the backbone and central focus of campus for most of the students studied, with residence halls as secondary centers, the Quad and areas of Muncie, next, and the "Village" is center for only a few. If this represents the general view of all students at Ball State University, it may indeed be a good idea for the

University to follow up on the plan to designate McKinley for pedestrian traffic only, as long as the north part of the campus is not neglected.

A major finding is that there were not many significant results for the drive/not drive comparison. It may be better to look at other forms of transportation relevant to college students and relate those to their map characteristics. A pre-tested method of analysis may be less subjective than the one used in this study as well. Furthermore, the results may reflect some demand characteristics developed by participants when they saw the various requirements for participation on the sign-up sheets, thinking how their map should be interpreted relative to their age, sex, or how they travel about campus. Other dependent variables that may be worthy of measuring in other studies include: does the participant participate in Greek life, or off-campus parties; did the participant include his/her own residence and where on their map was it located; how many public service buildings did they include-hospitals, police station, etc.; how did they fill up the blank page, did they use only a corner, both sides of the paper, etc.; did they only draw pictures with no labelling; how many nicknames for places did they use?

Other independent variables that could be observed in future studies include comparing different task instructions: "Draw Ball State/Muncie;" "Draw Muncie;" "Draw Ball State." It may be better to look at age in terms of years rather than

college level as well, or use different task time limits for different groups.

This study did show that significant differences in mental maps do exist for different groups within the general student population. When dealing with a specific group or individual, it may be of benefit to consider how they perceive a place and what things they notice or think of as most important prior to communicating to that person. For instance, based the results of this study, while giving directions to a male student, consider whether or not he will be driving. If he will be driving, give him street names; if he will be walking, give him landmarks to remember. A major point to remember is simply that not everyone views a place and remembers a place in the same way. We each have our own perceptive filter through which we experience the world (Gould, 1974).

Concepts of "whatness" and "whereness" are very easily recognized in the maps drawn by subjects in this study(Downs, 1977). There are definite differences observed between the various groups in what was labelled, and what was even recalled to be included on individuals' maps. Some subjects did not even put labels, having no names for things, but only shapes. For these individuals, maybe "whereness" is most important, emphasizing placement and relationships that each item on the map has with the other items included.

Both learning and socialization could be used to explain the results of this study, and could easily be used to explain the

differentiation of Downs' (1977) concepts. Males have been shown to possess strong spatial skills which relate to "whereness" and "whenness;" while females tend to be strong in verbal ability, "whatness." This could result from something genetic or something learned through society's influence in the raising of children. There are those 2-way interactions obtained that are more difficult to explain in such a way. Why do males include different things on their drawn maps when they drive regularly in a place versus not regular drivers? Why do women's maps remain more constant, despite their driving status? Maybe such differences can be explained by the types of movement made by the various groups. Maybe habitual movement for each group is different, and the same may apply for exploratory movement (Bechtel, 1970). For instance, males who drive may be more exploratory and responsive to street names while driving. While walking they may tend to be more responsive to landmarks. It is also possible that driving is a more habitual movement for males than females, causing males to notice only street names, while females notice a wider variety of things. Females may be equally exploratory while driving as walking as well.

Differences are definitely existent between the various groups observed in this study, yet the reasons for these differences are left to speculation. The more specific observations that can be made concerning the influences of variables on cognitive maps, the more likely it is that an accurate theory can be developed. Understanding the mental images had by people is crucial to any area related to the environment and experiencing

the natural and man-made world (Gould, 1974).

TABLE 1

Variable DefinitionsIndependent Variables

Age	Two groups were represented: freshman and soph0-mores at Ball State University
Sex	Two groups: males and females
Drive	Two groups: Those who drive regularly in Muncie, Indiana and those who do not

(All subjects were non-residents of Muncie, Indiana)

Dependent Variables ("\*" indicates significant findings)

<u>variable #</u>	<u>Variable name</u>	<u>definition</u>
* 1	Major Streets:	the number of main streets of Muncie, Indiana labelled by subjects
* 2	Minor Streets:	the number of side streets of Muncie, Indiana labelled by subjects
* 3	University Buildings:	the number of Ball State University owned buildings labelled by subjects
4	Schools:	the number of other schools labelled by subjects
5	Shops:	the number of retail stores, malls, etc. labelled by subjects
6	Food Places:	the number of grocery stores and restaurants labelled by subjects
7	Banks:	the number of bank branches and Money Movers labelled by subjects
* 8	Residences:	the number of residence halls, private homes, apartments and fraternities labelled by subjects

TABLE 1  
(continued)

<u>variable #</u>	<u>Variable name</u>	<u>definition</u>
9	Service Stations:	the number of gas stations labelled by subjects on their maps
10	Churches:	the number of religious centers labelled by subjects
11	Open Fields:	the number of sport fields, marching fields, large open areas, etc. labelled by subjects
* 12	Natural Landmarks:	the number of rivers, ponds, trees, hills, rocks, things of nature, etc. labelled by subjects
* 13	Man-made Landmarks:	the number of statues, tennis courts bridges, bus stops, parks, rail- road tracks, etc. labelled by subjects
* 14	Scramble Lights:	the number of pedestrian controlled stop lights labelled by subjects
15	Stop Lights:	the number of traffic control lights labelled by subjects
16	Stop Signs:	the number of traffic signs labelled by subjects
17	Parking:	the number of parking areas: lots, structures, etc. labelled by subjects
* 18	"North:"	the number of subjects' maps which had the word "north" on it

("\*" indicates significant findings resulted for this variable)

TABLE 1  
(continued)

<u>variable #</u>	<u>variable name</u>	<u>definition</u>
* 19	"East:"	the number of subjects who had the word "east" on their maps
* 20	"South:"	the number of subjects who had the word "south" on their maps
* 21	"West:"	the number of subjects who had the word "west" on their maps
22	Orientation of "Up":	the number of maps which had each of the following as "up" on their map: north, east, south, west
* 23	Campus North:	the number of subjects who included the area of campus north of the RB (Robert Bell) Building, north of the CAP (architecture) Building, and north of Neeley Avenue
24	Campus East:	the number of subjects who included the area of campus east of and including the WB (Whittinger) Building
25	Campus South:	the number of subjects who included the area of campus south of the AD (Administration) Building and including the village area and south of it
26	Campus West:	the number of participants who included the area of campus west of the AD Building, the Art Building, TC and RB

(\*\* indicates that significant results were found for that variable)



TABLE 1  
(continued)

<u>variable #</u>	<u>variable name</u>	<u>definition</u>
* 27	Campus Central:	the number of subjects who included the Quad, the area along McKinley Ave. from University Ave. to Neeley Ave., the RB, CAP, library, TC(Teacher's College), NQ(North Quad), EQ(East Quad), etc.
28	Off-campus North:	the number of subjects who included the area north of the Duch Pond to McGalliard
* 29	Off-campus East:	the number of subjects who included the area east of Studebaker Complex to Wheeling Ave. and east of the "Village"
30	Off-campus South:	the number of subjects who included the area south of the "Village" and Wagner Complex to White River
31	Off-campus West:	the number of subjects who included the area west of RB, Christy Woods, and the Johnson Complex parking lot to Tillotson Ave.
32	Muncie North:	the number of subjects who included the area north of McGalliard
33	Muncie East:	the number of subjects who included the area east of Wheeling Ave. and east of downtown Muncie, Indiana

("\*" indicates that significant results were found for this variable)

TABLE 1  
(continued)

<u>variable#</u>	<u>variable name</u>	<u>definitions</u>
34	Muncie South:	the number of subjects who included the area south of downtown Muncie, IN
35	Muncie West:	the number of subjects who included the area west of downtown Muncie, IN and Wheeling Ave.
36	Downtown	the number of participants who included the area of downtown Muncie
* 37	Center of Map:	the number of participants who centered their drawings around each of the following: library-TC, architecture-RB area, scramble light on Riverside Ave., a residence, Lafollette Complex, Studebaker Complex other areas of Muncie, the "Nunnery" Complex, and the "Village" area
38	Largest:	the number of participants whose largest scales area of their drawing was the following: the north, east, south, or west part of their maps, the Quad, the RB-architecture area, the university area, or no largest area
39	Smallest:	the number of subjects whose smallest scaled area was as listed in variable 38

("\*" indicates that significant results were found for this variable)

TABLE 1

(continued)

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<u>variable #</u>	<u>variable name</u>	<u>definitions</u>
40	lines	the number of subjects who represented roads in each of the following ways: one line, 2 parallel lines, multiple lines, or no lines

			FR	SO	M	F	DR	drive	FR-M	FR-F	SO-M	SO-F	FR-	FR-	SO-d	SO	M	M	F	F
													drive	no d	no d	no d	d	d	d	d
Number of Major streets labelled	1	2.92					3.56	2.09									2.76	.45	1.26	.87
							.016										p = .04		6	
Number of Minor Streets labelled	2	1.44	.90	2.61	1.86	1.08														
			.001		.0	.47														
Number of University Buildings labelled	3	9.79			6.84	12.32	8.51	12.32												
					.00	0	.032													
Number of residences labelled	8	3.32			2.70	3.86														
					.0	.13														
Number of Natural Landmarks labelled	12	.35															.24	.64	.35	1.26
																	p = .0		31	
Number of MAN made Landmarks labelled	13	.55	.43	.79													.24	.64	.35	1.26
			.0	.34													.0	.34	.35	1.26
Number of Scramble Lights labelled	14	.26	.33	.11																
			.0	.42																
Variable name	Variable number	Over-all Mean	Main Effects				2-Way Interactions													
			age	sex	drive		age-sex		age-drive		sex-drive									

TABLE 2  
Significant Results from Analysis of Variance  
(Means and significant of F given in boxes)

(p<.05)

TABLE 3

Significant Results from Chi-square Analysis  
p<.05

28

Variable	Variable Number	Percent of Population studied	Chi-square value	Significance of F
"north"	18	82% did not include	14.012	.05
"east"	19	86% "	17.75	.013
"south"	20	86% "	17.75	.013
"west"	21	86% "	17.75	.013
campus north	23	93% did include	21.88	.003
campus central	27	77% "	26.35	.000
campus east	29	86% did not include	26.99	.000
center of map	37	see Table 4	91.62	.01

TABLE 3 Location of Map Center (Variable 37)  
percent of population studied given  $p=.01$

Variable name campus lodation	percent of population centering their map around this
library-TC(Teachers College)	20.7%
architecture-RB(Robert Bell)	19.8%
scramble light on Riverside Ave.	19.0%
a residence	9.9%
Lafollette Complex	9.1%
Studebaker Complex	5.8%
Quad of campus	5.0%
another area in Muncie, IN	5.0%
"Nunnery" Complex	4.1%
"Village" area	1.7%

TABLE 5            Map Center (variable 37)  
by group

1. Percent of group population having location  
as map center given

2. Largest percent of group is underlined

3. Second largest percent of group also listed

group	campus location				
	architecture	library	scramble	residence	"Nunnery
	RB	TC	light	area	complex
FR-M-no drive	<u>23.8%</u>	19.0%			
FR-M-drive	<u>30.0%</u>		25.0%		
FR-F-no drive	16.7%		<u>27.8%</u>		
FR-F-drive	25.0%	25.0%			
SO-M-no drive		23.1%		<u>38.5%</u>	
SO-M-drive			<u>100.0%</u>		
SO-F-no drive	<u>25.0%</u>	18.8%			
SO-F-drive		<u>57.8%</u>			28.6%
TOTAL % FOR EACH LOCATION of over-all population studied	19.8%	20.7%	19.0%	9.9%	4.1%

TABLE 6 (A) Largest area of map drawing (variable 38)

(these results are not statistically significant)

area	percent of population studied
north	25.6%
no part largest	23.1%
south	14.0%
east	12.4%
Quad	9.9%
west	3.2%

(B) Smallest area of map drawing (variable 39)

(these results are not statistically significant)

area	percent of population studied
no part smallest	28.9%
north	19.0%
Quad	16.5%



TABLE 7

Number of lines used to represent roads  
on subject drawings

1. Percent of population studied given

2. Largest percent for group underlined

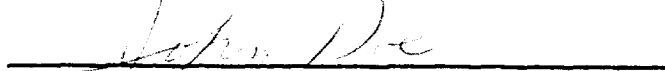
GROUP	2 lines	1 line	no lines	multiple lines
over-all population	52.9%	40.5%	5.8%	.87%
FR-M-no drive		<u>57.1%</u>		
SO-M-do drive	30.8%	<u>46.2%</u>		
FR-M-drive	45.0%	45.0%		
SO-M-drive	50.0%	50.0%		
FR-F-no drive	<u>55.6%</u>			
SO-F-no drive	<u>62.5%</u>			
FR-F-drive	<u>56.3%</u>			
SO-F-drive	<u>100.0%</u>			

- 1 Females tend to use two lines
- 2 Males who do not drive in Muncie regularly use one line most
- 3 Males who do drive in Muncie regularly go 50%-50% using one and two lines equally

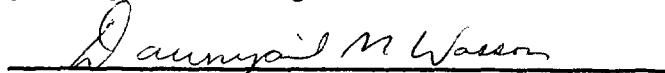
## Consent Form

As a participant in this study you will be asked to draw a map of a specified area within a 10 minute time limit, and then asked to fill out a variable identification questionnaire concerning class status, sex and transportation methods used in muncie. You will be given a blank sheet of paper to draw on with a code to match the questionnaire. The responses remain anonymous. You may experience some anxiety while completing your drawing within the time given. The reason for this time limit is to limit the amount of data recorded and maintain consistency of method across participants. If the time limit will be excessively stressful, you may freely opt not to participate. Results from this study will help to develop a better understanding of how individuals uniquely experience a place.

participant's signature



principal investigator



Dawnyail M. Wasson

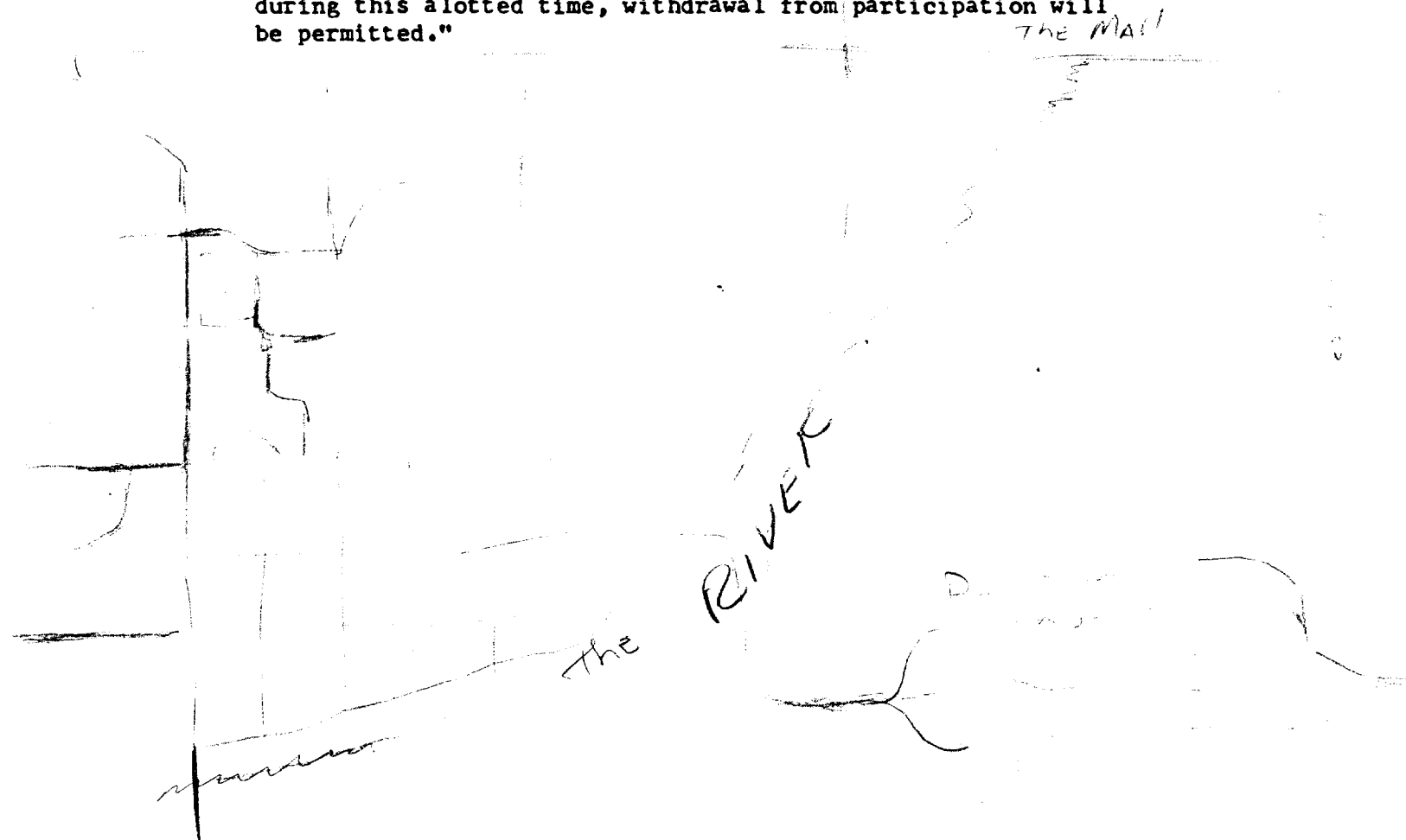
Senior, PSYSC Dept.

286-0912

## APPENDIX B

(Verbal instructions given prior to handing out blank papers:)

"You will have 10 minutes to draw your personal map of the Muncie/  
Ball State University area. Include those major elements that  
form your map. If you become stressed or excessively uncomfortable  
during this allotted time, withdrawal from participation will  
be permitted."



## APPENDIX C

## Variable Identification Questionnaire

Circle the letter of the best answer

1. Status: ☒ A. freshman  
          ☐ B. sophomore
2. Sex: ☒ A. male  
         ☐ B. female
3. Do you drive a car in Muncie?  
     ☐ A. yes  
     ☒ B. no

-----  
Additional Information

4. Do you use the bus system on campus?  
   ☐ A. yes  
   ☒ B. no
5. Do you use the bus system to travel within the city of Muncie?  
   ☐ A. yes  
   ☒ B. no
6. Do you ride a bicycle on campus?  
   ☒ A. yew  
   ☐ B. no
7. Do you ride a bicycle to travel about the Muncie area?  
   ☒ A. yes  
   ☐ B. no
8. Do you run or jog in the campus area?  
   ☒ A. yew  
   ☐ B. no
9. Do you run or jog about the city of Muncie?  
   ☐ A. yew  
   ☒ B. no
10. Do you walk in areas away from campus?  
    ☐ A. yes  
    ☒ B. no
11. Do you only walk in the campus area?  
    ☒ A. yes  
    ☐ B. no
12. Where do you reside?  
    ☒ A. dorm  
    ☐ B. off campus  
    ☐ C. in another town  
    ☐ D.
13. Name where you live? (i.e. Auburn, IN...OR Schmidt Hall, etc.)  
    Winters Hall
14. Code on upper right corner of map drawing?  
    Code AB

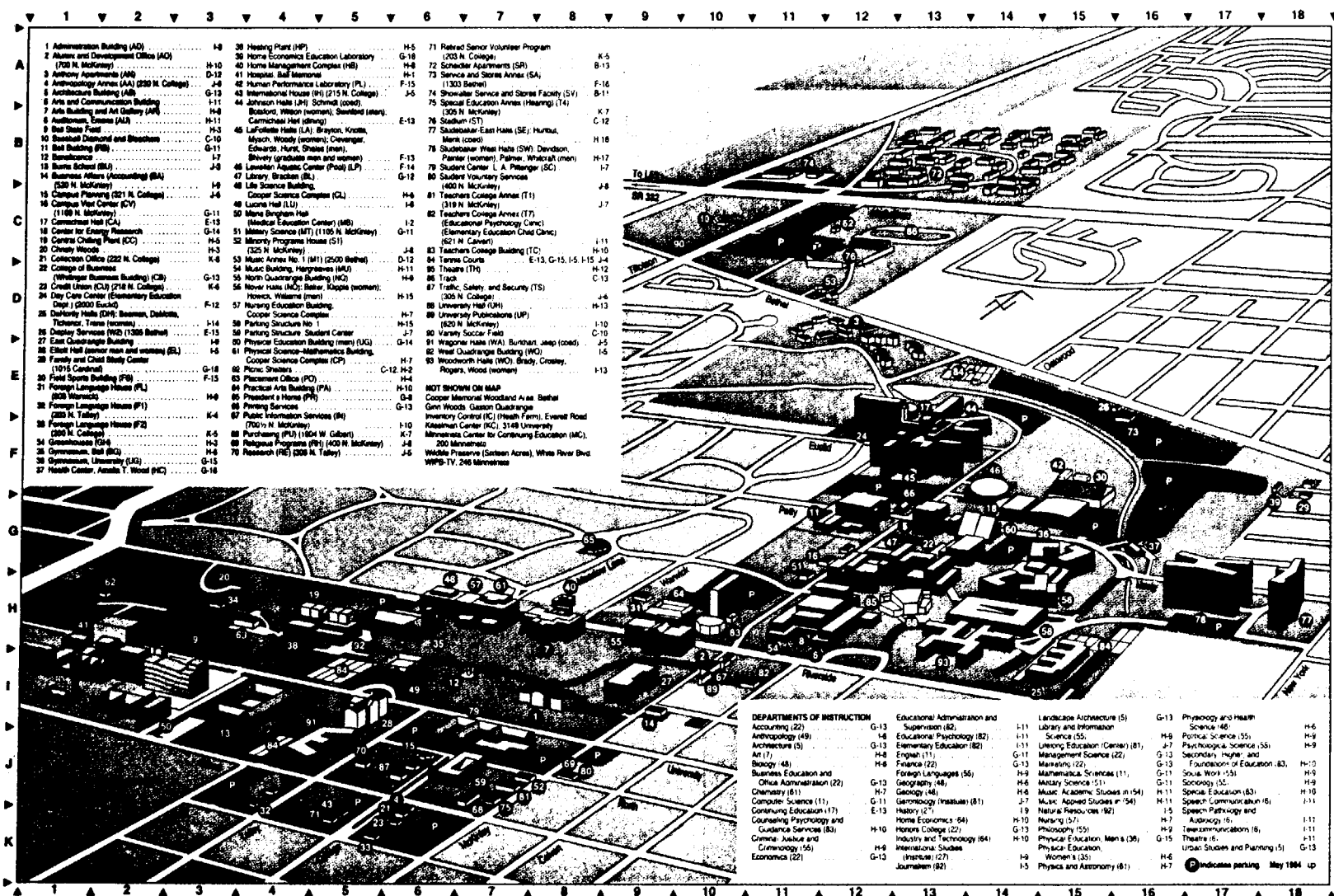
Independent Variables used

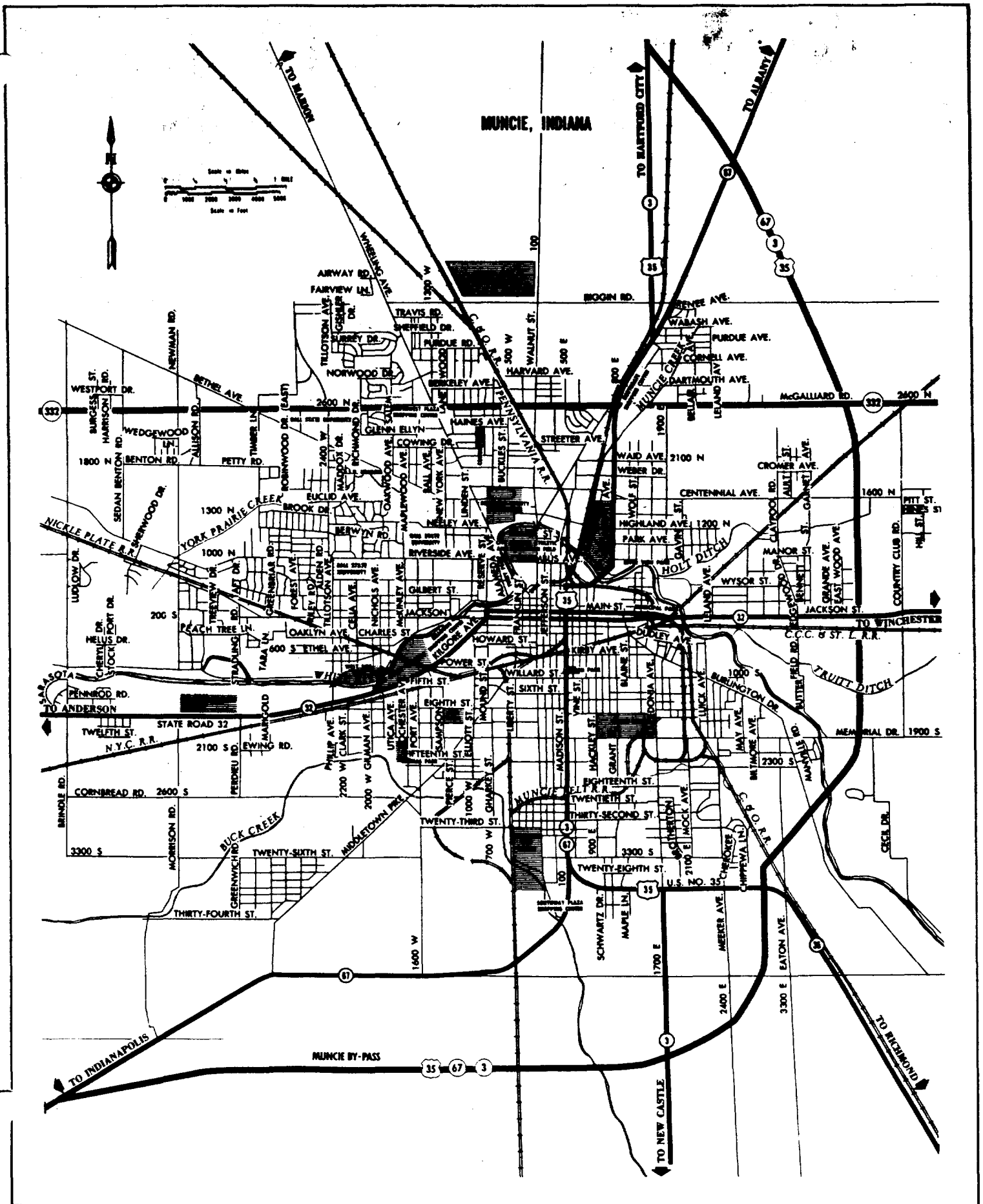
(refer to Table 1)

Dependent Variables used

(refer to Table 1)

# Ball State University Campus





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